The developing visual system is structured and organized even before the onset of vision. Spontaneous neural activity on the retina that spreads in waves has been suggested to play a major role in these prenatal structuring processes [8]. Recently, Albert et al [1] have shown that when employing an efficient coding strategy, such as sparse coding, these retinal activity patterns lead to basis functions that resemble optimal stimuli of simple cells found in primary visual cortex (V1).

Slow Feature Analysis (SFA) [7] has been successful in reproducing a rich set of complex cell features if trained with natural image sequences [2]. Here we present the results of applying SFA to image sequences derived from natural images as well as different models of retinal waves [4]. In order to compare our results with those from classical neurophysiological experiments on V1 cells, we tested the obtained SFA units with sinusoidal gratings of different spatial frequency, orientation, and phase.

The SFA units obtained share a number of features with V1 complex cells such as orientation- and frequency tuning as well as phase invariance. These features are present when trained with natural image sequences and to a large degree also when trained with models of retinal waves. Hence, retinal waves seem suitable training stimuli to learn invariances and thereby shape the developing early visual system so that it is well prepared for coding input from the natural world.

References